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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/348,885	07/01/1999	DAVID C. TANNENBAUM	15-4-849.00	5888

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EXAMINER
WILEY, SAM A

ART UNIT	PAPER NUMBER
2671	

DATE MAILED: 06/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/348,885	TANNENBAUM, DAVID C.
	Examiner	Art Unit
	Sam A Wiley	2671

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 4
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1,7,8,9,11,17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over King (5,187,796), and further in view of Wang (5,187,796).

Regarding claims 1, King discloses (column 6, lines 63-66) a unit for multiplying two N component vectors that is essentially a complex dot product device. Wang teaches (column 8, lines 8 –11) a processor which is designed to efficiently perform vector/vector operations, including cross product operations.

It would have been obvious to one of ordinary skill at the time of the invention to combine the dot product unit of King with the cross product processor of Wang to produce a dual-mode device which can calculate both dot product and cross product operations, because such a device would be useful in a system such as a computer graphics system where both dot and cross product operations might be needed, and it would be useful to reduce complexity by having one device which can perform both operations.

It would further have been obvious to one of ordinary skill in the art at the time of the invention to include as part of the device a controller for receiving a signal indicating which of the operations to perform, since without such a controller the device would be unable to determine which operation would yield the desired output.

Regarding claim 7, Wang discloses (column 4, lines 41-42) multiple multipliers and adders are included within a device used to generate cross products.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include within the present invention a plurality of multipliers and adders, because, as discussed above, it would be obvious to combine the unit disclosed in King with the device disclosed in Wang, which itself contains multiple adders and multipliers. A plurality of adders and multipliers would be useful in calculating both cross products and dot products, since both lend themselves well to parallel processing by having independent components that can be operated upon simultaneously.

Regarding claims 8 and 17, King discloses (column 2, lines 20 –48) a method for solving a dot product in which two vectors are first multiplied by a complex multiplier, which consists of multiplying and summing circuits.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use at least one multiplier and one adder to solve both dot products and cross products, because King has disclosed such a method for dot products, and modifying such a method to be used for cross products would be trivial, since the same vector structure would be used for both.

Regarding claims 9 and 11, King discloses (column 2, lines 8-11) multiple complex multipliers that are set to each receive a separate component of a vector for the purpose of multiplication.

It would thus have been obvious to one of ordinary skill in the art at the time of the invention to include within the present invention sub-units that are intended to

generate a particular component of a cross product evaluation, because such a arrangement is disclosed in King for a dot product, and converting such an arrangement to operate on cross products would be useful because, as noted above, cross products and dot products are used in many of the same applications.

It would also have obvious to include within the present invention a plurality of units capable of solving dot and cross products, since this arrangement is also similar to the arrangement disclosed in King, and converting such an arrangement to operate on cross products would be useful because, as noted above, cross products and dot products are used in many of the same applications.

Regarding claims 6, Wang teaches (column 13, table 2) a device which uses an algorithm for calculating a vector cross product in which two vectors each have three components x, y and z, and the resultant vector of the cross product also has three components x, y and z.

If the combined device were capable of producing dot products, it would have been obvious to calculate a dot product from two vectors, each with three components, using all the components as in claim 6, since the dot product mode of the device should be capable of using the same possible input as the cross product mode to maximize the versatility of the dual mode unit.

Regarding claim 18, neither Wang nor King teaches the method disclosed in the present invention. However, as noted above, combining the two inventions disclosed in Wang and King would yield a device, that, if operated, would use the method described in claim 18.

It would have been obvious to have the device receive the first and the second vectors, because the first and second vectors are necessary components to generate cross and dot products, the generation of which is the purpose of the device. It would further have been obvious to receive a signal indicating whether to generate a cross product or a dot product, because the device is capable of generating either, and some method would have to be used to select between the two.

It would further have been obvious select the vector components to be used in a cross product, because to effectively calculate a cross product, the specific components to be operated on must be identified.

It would further be obvious to ultimately generate either a cross or a dot product, because the generation of one of the products is the final purpose of the combined device made obvious by King and Wang.

Claims 4,5,10,12,13,14,15,16,19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over King (5,187,796), and further in view of Wang (5,187,796) as appliedto claim 1 above, and further in view of Foley, *Computer Graphics: Principles and Practice, 2nd Edition*.

Regarding claims 10 and 15, Foley teaches that specular lighting and spot-lighting requires the use of a dot product (pg. 729 and pg. 732), and that diffuse lighting requires the use of normalization, which is a cross product (pg. 724).

It would have been obvious to one skilled in the art at the time of the invention to apply to combined device of King and Wang discussed above to the tasks of calculating specular, diffuse, and spot lighting, because these two of these calculations require dot

products and one require a cross product, and the device discussed above has both of these capabilities.

Regarding claims 13 , Wang teaches (column 13, table 2) a device which uses an algorithm for calculating a vector cross product in which two vectors each have three components x, y and z, and the resultant vector of the cross product also has three components x, y and z.

It would have been obvious to one skilled in the art at the time of the invention to calculate a cross product using two vectors that each have three components and a resultant vector also having three components as in claim 13, since the exact same arrangement is seen in Wang, and as noted previously, it would have been obvious to combine this with the unit disclosed in King so that it is also capable of calculating dot products.

Regarding Claim 16, Wang discloses (column 4, lines 41-42) multiple multipliers and adders are included within the device described above.

It would have been obvious to one of ordinary skill in the art at the time of the invention to include within the present invention a plurality of multipliers and adders, because, as discussed above, it would be obvious to combine the unit disclosed in King with the device disclosed in Wang, which itself contains multiple adders and multipliers. A plurality of adders and multipliers would be useful in calculating both cross products and dot products, since both lend themselves well to parallel processing by having independent components that can be operated upon simultaneously.

Regarding claims 5,12, and 19, Foley (pg.1104) describes the method of performing a cross product operation. The resulting vector clearly requires that several of the components undergo a sign change; for example, if the cross product of vectors $v=[v_1, v_2, v_3]$ and $w=[w_1, w_2, w_3]$ is generated, then the first component of the resultant vector would be $v_2w_3 - v_3w_2$.

It would therefore have been obvious to one of ordinary skill in the art at the time of the invention to have a controlling unit switch the signs of certain components in the generation of a cross product, because this is an inherent step in the process of generating a cross product, and well know within the art.

Regarding claim 4, as noted in the preceding paragraph, Foley (pg.1104) describes a method for generating a cross product from two vectors.

It would have been obvious to one of ordinary skill in the art at the time of the invention to select the vector components that are not generated in one particular step of performing a cross product, because according to the method described in Foley, it necessary to choose other components to be crossed with the specific component being operated in on in that step.

Regarding claim 14, King teaches (column 6, lines 63-66) a processing unit used to generate dot products.

It would have been obvious to one skilled in the art at the time of the invention to include within the device disclosed by King the capability the cross product generation capability disclosed by Wang, and a signal to indicate that the dual mode device should generate a dot product using the inputted vectors.

Regarding claim 20, King discloses (column 2, lines 8-11) multiple complex multipliers that are set to each receive a separate component of a vector for the purpose of multiplication.

It would thus have been obvious to one of ordinary skill in the art at the time of the invention to include within the present invention a method to generate a particular component of a cross product evaluation in parallel, because a device using such a method is disclosed in King for a dot product, and converting such an arrangement to operate on cross products would be useful because, as noted previously, cross products and dot products are used in many of the same applications.

Response to Arguments

Applicant's arguments filed February 26, 2002 have been fully considered but they are not persuasive.

Regarding the rejection of claims 18-20 under 35 U.S.C. 101, the rejection is withdrawn in view of the amended claims.

Regarding the rejection of claim 3 under 35 U.S.C. 112 first paragraph, the rejection withdrawn in view of the amended claim.

Regarding the rejection of claims 2, 3, and 18 under 35 U.S.C. 112 second paragraph, the rejection is withdrawn in view of the amended claims.

Regarding the rejection of claims 1, 7, 8, 9,11,17 and 18 under 35 U.S.C. 103(a), applicant argues that King does not teach the calculation of cross products. However, applicant does note that such an algorithm is taught by Wang. As noted previously, it would have been obvious to one of ordinary skill in the art at the time of the invention to

combine the inventions of Wang and King, because there are many fields in the computer art, such as graphics and simulation, where dot product and cross product operations are used extensively. Such a combined device would be a significant improvement over using a separate device for each operation, as it would reduce system overhead as well as reduce the physical size of the system.

Applicant further argues that neither Wang nor King teach a signal indicating whether to generate a cross or dot product. However, such a signal would have been obvious to one of ordinary skill in the art at the time of the invention, because a device that combined the features of Wang and King would by necessity require some means to indicate which function to use at any given time.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, the extensive range of fields that require the use of both cross products and dot products is well known and generally available to one of ordinary skill in the art. Computer graphics, advanced physical simulation and modeling, and any other system that requires mathematical operations in three dimensions, all make use of

devices for calculating both dot and cross products, and thus provide the motivation for combining such devices, since they so frequently appear in the same systems.

Regarding the rejection of claims 4,5,10,12,13,14,15,16,19, and 20 under 35 U.S.C. 103(a), applicant argues that neither Wang nor King teach a signal indicating whether to generate a cross or dot product. However, as noted above, such a signal would have been obvious to one of ordinary skill in the art at the time of the invention, because a device that combined the features of Wang and King would by necessity require some means to indicate which function to use at any given time.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Sam Wiley** whose telephone number is **(703) 605 - 4248**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Mark Zimmerman**, can be reached at **(703) 305-9798**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

MARK ZIMMERMAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600